# Building Assessment

# Quality Control Inspector

Learning Objectives

 By attending this session, participants will be able to:

* Explain the concepts of the air barrier and thermal boundary.
* Recognize whether appropriate energy-saving measures were installed.
* Determine whether there were missed opportunities for energy saving measures.
* Evaluate whether energy-related repairs and health and safety measures were justified.
* Judge whether installed measures meet weatherization program specifications and standards for quality workmanship.

Key Terminology

Action levels

Air barrier

Balloon framing

Band joist

Base load

Cantilever

Carbon monoxide (CO)

Combustion appliance zone (CAZ)

Compact fluorescent light (CFL)

Condensation

Conductive heat loss

Cubic feet per minute (CFM)

Decommission

Dense-pack insulation

Dropped soffit

Health and safety (H&S)

Indoor air quality (IAQ)

Infrared (IR)

Infrared imaging

Infrared thermography

International Residential Code (IRC)

Knee wall

Knob and tube wiring

Loose-fill insulation

Manual J

Mud sill

National Electrical Code (NEC)

National Fire Protection Association (NFPA)

Net free area (NFA)

Parts per million (ppm)

Pascals (Pa)

Pull-down staircase

R-value

Savings-to-investment ratio (SIR)

Shading coefficient (SC)

Solar absorption

Solar exposure

Solar film

Solar gain

Solar reflectance

Thermal boundary

Tuck-under garage

U-factor

Vapor retarder

Vent

Vermiculite

Weatherization Program Notice (WPN)

Window film

With reference to (WRT)

Zonal pressure diagnostics (ZPD)

Supplemental Materials

Handouts & Resources

Armanda, Larry. “Ventilation Strategies in Weatherization.” *WTC Technical Update* 1.8 (2006). Weatherization Training Center at Pennsylvania College of Technology. <www.pct.edu>.

Attic Air Sealing Video.

Attic Insulation Certificate.

Beers, Jonathan. “Dryer Venting.” *Home Energy* Nov./Dec. 2003: 14-16.

“Blower Door Basics: Part 1 - Prep and Setup.” WxTV. Montana Weatherization Training Center. <www.wxtvonline.org>.

“Blower Door Basics: Part 2 - The Test Process.” WxTV. Montana Weatherization Training Center. <www.wxtvonline.org>.

“Blower Door Basics: Part 3 - The Breakdown.” WxTV. Montana Weatherization Training Center. <www.wxtvonline.org>.

Bohac, David. “Zone Pressure Diagnostics.” *Home Energy* May/June 2002: 32-37. <www.homeenergy.org>.

“Boiler Basics: Part 1 - Combustion Air and Drafting.” WxTV. Montana Weatherization Training Center. <www.wxtvonline.org>.

“Boiler Basics: Part 2 - Clean, Test, and Tune.” WxTV. Montana Weatherization Training Center. <www.wxtvonline.org>.

“Boiler Basics: Part 3 - External Components.” WxTV. Montana Weatherization Training Center. <www.wxtvonline.org>.

Boles, Bill. “Missteps with Mold.” *Home Energy* 19 June 2006. <www.homeenergy.org>.

Building Assessment Quiz.

Building Assessment Quiz Answer Key.

CO Probe Locations Illustration.

Fisette, Paul. “Q&A: Causes of Attic Mold.” Journal of Light Construction Nov. 2004. <www.jlconline.com>.

Fisette, Paul. “Q&A: Roof Venting in a Wet Climate.” Journal of Light Construction Feb. 2011. <www.jlconline.com>.

Florida Solar Energy Center. “Window Orientation and Shading.” 2007. <www.fsec.ucf.edu>.

“Gas Furnace Basics: Part 1 - Initial Assessment.” WxTV. Montana Weatherization Training Center. <www.wxtvonline.org>.

“Gas Furnace Basics: Part 2 - Testing the Unit.” WxTV. Montana Weatherization Training Center. <www.wxtvonline.org>.

“Gas Furnace Basics: Part 3 - Troubleshooting High CO.” WxTV. Montana Weatherization Training Center. <www.wxtvonline.org>.

“Gas Furnace Basics: Part 4 - Cleaning and Final Assessment.” WxTV. Montana Weatherization Training Center. <www.wxtvonline.org>.

“Health and Safety Series: Getting Started.” WxTV. Montana Weatherization Training Center. <www.wxtvonline.org>.

“Health and Safety Series: Mold and Moisture.” WxTV. Montana Weatherization Training Center. <www.wxtvonline.org>.

“Heating Basics: A Tour of 9 Systems.” WxTV. Montana Weatherization Training Center. <www.wxtvonline.org>.

Indiana Community Action Association. INCAP Daily Safety Test-Out Procedure Summary Sheet <www.incap.org>.

La Rue, Jim. “A Conditioned Crawlspace Checklist.” *Home Energy* May/June 2004: 24-26. <www.homeenergy.org.>

Moore, Alex. “Loose-Fill Insulation Coverage Chart.”

National Fire Protection Agency. “Combustion Clearance Tables.” <www.nfpa.org>.

Quality Control Checklist handout.

Quality Control Inspector Pilot Exam Certification Scheme Handbook. BPI/NREL Certifications. BPI, Inc. April 4, 2012. <www.bpi.org>

Refrigerator Info Toolkit.

Sample Quality Assurance Form.

Sample Technical Field Rating Sheet.

Sterner, Tamasin. “Cooling Measures.” In *Winter Relief Assistance Program Standards*. Pennsylvania Power & Light. 2007.

Turk, Brad. “Crawlspaces, Considering the Options.” *Home Energy* May/June 2004: 30-33. <www.homeenergy.org>.

U.S. Department of Energy. Energy Efficiency and Renewable Energy. “Combustion Equipment Fact Sheet.” Oct. 2000.

U.S. Department of Energy. Hot Climate Initiative. *Air Sealing.*

U.S. Department of Energy. Hot Climate Initiative. *Combustion Appliance Safety & Efficiency Testing.*

U.S. Department of Energy. Hot Climate Initiative. *Dense-pack Sidewall Insulation.*

U.S. Department of Energy. Weatherization Assistance Program. “WPN 11-6 Health & Safety Guidance.” 12 Jan 2011 <www.waptac.org>.

U.S. Department of Labor. Occupational Safety and Health Administration. “Mold Fact Sheet.” 2005. <www.osha.gov>.

Van der Meer, Bill. “Air Leakage in Recessed Lighting.” *Builder Brief* (BB0502). Undated. Pennsylvania Housing Research Center, Penn State University. <www.engr.psu.edu>.

Van der Meer, Bill. “Air Sealing with Two Part Foam.” *WTC Technical Update* 1.4 (2003). Weatherization Training Center at Pennsylvania College of Technology. <www.pct.edu>.

Van der Meer, Bill. “Avoiding Moisture Problems.” *WTC Technical Update* 1.1 (Feb. 2003). Weatherization Training Center at Pennsylvania College of Technology. <www.pct.edu>.

Water Heater Info Toolkit.

Weatherization Assistance Program Standardized Curriculum. “Blower Door Basics.” Oct. 2011. PowerPoint presentation.

**Online Platform Lessons**

Use these online interactive training modules as prerequisites before students attend the course or as in-class computer lab sessions. Users must first create an account at [www.nterlearning.org](http://www.nterlearning.org) to access the lesson.

a- 2.0 Visual Assessment <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 2.1 Exterior Walkaround <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 2.2 Interior Walkaround <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 2.3 Attic Assessment <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 2.4 Basement/Crawl Space Assessment
<https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 2.5 Furnace Inspection <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 2.6 Water Heater Inspection <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 2.7 Building Measurements <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 2.8 Gas Leak Detection <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 4.1 Combustion Safety Testing - Gas Range
<https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 5.1 Evaluating Attic Insulation <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 7.1 Target Air Leakage Reductions <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 7.2 Room Pressure Tests, Thermal Boundary and Add-a-Hole ZPD Case Study
<https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 8.3 Mechanical Ventilation <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 9.1 Measuring Duct Leakage with a Blower Door
<https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 9.2 Pressure Pan Testing <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 9.3 Dominant Duct Leakage <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 9.4 Duct-Blower Leak Testing <https://www.nterlearning.org/web/guest/course-details?cid=248>

a- 9.5 Duct Induced Room Pressure Imbalance
 <https://www.nterlearning.org/web/guest/course-details?cid=248>

c- 4.1 Daily CAZ Testing <https://www.nterlearning.org/web/guest/course-details?cid=247>

c- 4.2 Combustion Safety Testing: Water Heater and Furnace/Boiler
<https://www.nterlearning.org/web/guest/course-details?cid=247>

c- 10.1 Identifying Heating Equipment <https://www.nterlearning.org/web/guest/course-details?cid=247>

c- 10.2 Identifying Hot Water Systems <https://www.nterlearning.org/web/guest/course-details?cid=247>

c- 10.3 Identifying Combustion Exhaust
<https://www.nterlearning.org/web/guest/course-details?cid=247>

c- 10.4 Identifying Cooling Equipment <https://www.nterlearning.org/web/guest/course-details?cid=247>

i- 3.4 Building Envelope, Thermal Envelope, Pressure Boundary & Conditioned Space
<https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 3.7 Building Variations (Animated Glossary)
<https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.0t Blower Door Basics <https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.1.1 Setting up a Blower Door Part 1
<https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.1.2 Setting up a Blower Door Part 2
<https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.1.3 Setting up a Blower Door Part 3
<https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.2 Preparing for a Blower Door Test
<https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.3 Blower Door Test Procedures
<https://www.nterlearning.org/web/guest/course-details?cid=249>

i- 7.4 Interpreting CFM50 Readings
<https://www.nterlearning.org/web/guest/course-details?cid=249>

**Relevant Standard Work Specifications**

1.105.1 - Combustion Worker Safety

1.110.1 - Material Selection, Labeling, and Material Safety Data Sheets (MSDSs)

1.200 - Combustion Safety Testing

1.300 - Safety Devices

1.401.1 - Air Sealing Moisture Precautions

1.402.1 - Crawl Spaces - Drainage

1.403 - Vapor Barriers

1.500 - Radon

1.600 - Electrical

1.700 - Occupant Education & Access

1.702 - Installed Equipment

3.000 - Air Sealing

4.000 - Insulation

5.000 - Heating and Cooling

6.000 - Ventilation

7.8001.1 - Refrigerator and Freezer Replacement

7.8003.1 - Lighting Upgrade

7.8101.1 - Shower Head and Faucet Aerator

7.8102 - Installation and Replacement

7.8103 - Maintenance Inspection

Classroom Props & Activities

**Sample Site Monitoring Quality Assurance Form**

* Acquaint students with the quality assurance (QA) form they will be using during a planned field trip.
* Focus on the information being requested.
* Tell students that filling in the blanks in order is usually most efficient.
* Instruct students to fill the appropriate check box or blank. (If it’s filled in, you know you’ve evaluated it!) Empty spaces indicate further searching is needed. If a field is not applicable, write ‘N/A.’
* Use the notes sections to provide more detail on what was done, or not done, in the home.
* The completed form should accurately reflect what was done to the home.

Remember: A completed QA form should be able to stand on its own; that is, any reasonably competent person should be able to determine from the form what was done to the dwelling.

**Hands-On Activities**

Class Field Trip

Plan to take the class to a home that has been completed by a local weatherization agency. The purpose is to conduct a full quality assurance assessment. Work with the local agency to identify a homeowner who is willing to have an inspection performed by a group of students under the direction of a knowledgeable instructor.

The agency may not be able to provide you with detailed information from the client file such as client information, inventory records, or measure justification. It will, however, be likely to give you a summary of the measures installed. Focus attention on whether measures appear to have been installed according to specifications and that quality workmanship was employed. If the agency can provide the individual audit report or priority list and other measure-related documents from the client file, consider using it for the “Desk Monitoring” section of this curriculum.

The house should be a typical single-family home, ideally with an operating forced-air furnace, an attic, and a basement or crawl space. Other features, such as an attached garage or additions, are desirable. Visiting a completed mobile home would also be interesting.

Before the visit, spend about 45 minutes to an hour in the classroom reviewing the sample QA form to make sure everyone understands how to use it. Review the Field Guide for the QC Inspector field exam, pointing out the various diagnostic tests required by that job category. Use this as a checklist for the activities to perform at the home.

Plan to spend two to three hours in the home conducting a visual assessment and diagnostic tests. Provide students with QA forms, flashlights, measuring tapes, and clipboards with paper, pencils, and copies of the field guide list of tasks.

Plan to take digital pictures. Allow students to disperse into small groups and regroup periodically to assess their progress, discuss findings, and watch or take part in activities such as duct leakage testing, blower door testing, infrared scanning, or zonal pressure diagnostics. Students should discuss negative findings with the instructor only and away from clients entirely.

After the field visit, reassemble in the classroom and let the students share their observations. The instructor should facilitate a discussion of the relative importance of each piece of data and how that data will ultimately fit into a fully documented QA assessment. Show the photos taken at the site to enhance the discussion of specific features observed at the home.

Divide the class into groups to reach consensus about major categories of weatherization measures, including heating system improvements, attic measures, and health and safety measures. Have each group designate one person to report its findings to the class. Allow 10 minutes per group for reporting, then discuss as a whole. To enhance the discussion, project digital images onto a screen showing weatherization details or special features of the home.

**Class Overview**

* Deliver the PowerPoint presentation. Focus on a systematic approach for performing inspections on homes and what inspectors should be looking for when conducting a building assessment.
* The PowerPoint presentation follows the sequence of categories on the sample QA form. These are associated with specific slides and are queued up in the speaker notes. Have students keep the QA form handy throughout the presentation.
* There are infinitely more possible scenarios that will manifest themselves in the field than those discussed in this presentation. Feel free to insert additional pictures and encourage students to share their experiences.
* Introduce students to the key elements of a complete QA building assessment, including:
	+ Inspection protocol
	+ Installed measures
	+ Insulation levels
	+ Selection of materials
	+ Accounting for materials
	+ Health and safety issues
* Use the presentation to introduce the concept of air barriers and thermal boundaries, reinforcing what’s inside and what’s outside the boundaries.